From the Cover: Thirdhand Cigarette Smoke Causes Stress-Induced Mitochondrial Hyperfusion and Alters the Transcriptional Profile of Stem Cells.

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Public Summary:
Thirdhand cigarette smoke (THS) was recently recognized as an environmental health hazard; however, little is known about it effects on cells. Mitochondria are sensitive monitors of cell health and report on environmentally induced stress. We tested the effects of low levels of THS extracted from terry cloth on mitochondrial morphology and function using stem cells with well-defined mitochondria. Concentrations of THS that did not kill cells caused stress-induced mitochondrial hyperfusion (SIMH), which was characterized by changes in mitochondrial morphology indicative of fusion, increased mitochondrial membrane potential (MMP), increased ATP levels, increased superoxide production, and increased oxidation of mitochondrial proteins. SIMH was accompanied by a decrease in Fis1 expression, a gene responsible for mitochondrial fission, and a decrease in apoptosis-related genes, including Aifm2, Bbc3, and Bid There was also down regulation of Ucp2, Ucp4, and Ucp5, genes that decrease MMP thereby reducing oxidative phosphorylation, while promoting glycolysis. These effects, which collectively accompany SIMH, are a prosurvival mechanism to rescue damaged mitochondria and protect cells from apoptosis. Prolonged exposure to THS caused a reduction in MMP and decreased cell proliferation, which likely leads to apoptosis.

Scientific Abstract:
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